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The Rising Sophomore Abroad Program: Early Experiential Learning in Global Engineering

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ABSTRACT

Multiple reports suggest that future engineering work will be conducted by globally diverse teams for globally diverse customers. Despite the demonstrated benefits of study abroad opportunities to develop such global competencies, undergraduate engineers participate at low rates. The Rising Sophomore Abroad Program presented in this paper describes an integrated class experience combined with an international field trip that has experienced rapid growth over the past few years and effectively scaled up to enroll 135 students in the 2017 program (8% of the incoming first-year engineering cohort). Program evaluation demonstrates that students achieved a range of global learning outcomes in both the class as well as the short-term study abroad module, and this blended approach may overcome some of the deficiencies of short-term programs while promoting future international engagement among undergraduate engineers. We outline unique program elements that other institutions might implement as they seek to expand students' international opportunities.

Key words: Global engineering; Study abroad; Cultural competence

INTRODUCTION

> *It is very easy to conclude that U.S. engineers will face totally different problems from the ones we face today…U.S. engineers will represent a minority culture and, thus, will have to be open to different religions, different ways of thinking, and different social values.*
> (National Academy of Engineering 2005, 152)

Undergraduate engineering programs must change along with the rapidly changing global landscape of the engineering profession. Such change is necessary because a more globally interdependent society brings with it a host of new and complex challenges that engineers will play a vital role in addressing (Duderstadt 2010; Jamieson and Lohmann 2009, 2012; National Academy of Engineering [NAE] 2004; National Research Council 2012). Several national reports characterize future engineering work to be comprised of globally diverse and distributed teams and customers, and in this environment, engineers will be required to communicate across political and cultural boundaries (e.g., Jamieson and Lohmann 2009; NAE 2004, 2005). To help prepare students to enter such a workforce, engineering programs should seek ways to educate "global engineers" by integrating and expanding meaningful opportunities, both abroad and at their home institutions, for students to develop global competence (Jamieson and Lohmann 2009; Johri and Jesiek 2014).

As professional work has become more globalized, students (including engineers) have increasingly recognized the importance of engaging globally. From 2000 to 2013, for example, the number of all students studying abroad nearly doubled, and the number of engineers studying abroad nearly tripled (Institute of International Education [IIE] 2015). However, engineering students have been underrepresented among study abroad participants historically (IIE 2015), and although the percentage of engineering students studying abroad has grown since 1950, it still hovers around 5% (IIE 2015). Several factors contribute to engineering students' lack of participation, including full and highly sequenced (i.e., rigid) engineering curricula, inability to transfer credits back to home institutions, and challenges scheduling international experiences around internships (e.g., Grandin and Hirleman 2009; Parkinson 2007). Revised curricular approaches that work within these constraints are necessary so that a greater percentage of engineering students have the opportunity to develop global competency. Moreover, as institutions are being pressured to reduce students' time to degree, solutions that add courses or even semesters to the required curriculum are not viable—global competence development needs to be integrated into required curricula.

This paper describes a program geared toward first-year engineering undergraduates that has experienced rapid growth over the past few years. The program integrates a global engineering course meeting general education requirements with multiple tracks of short-term international

experiences. The program provides students with opportunities to expand their global competencies while learning about differences in political, technological, social, cultural, educational, and environmental systems in a format that does not increase time to degree nor inhibit summer internship opportunities. By equipping students with an international lens so early in their curricula, this program aims to lay a foundation for students' perceptions and activities for the rest of their time in university and beyond. We present a detailed overview of the program as well as data that we have systematically collected to demonstrate its effectiveness at meeting its objectives. Given its success and continued growth, we hope the program may serve as a model for other institutions seeking to develop creative ways to expand students' international opportunities.

In the following sections, we describe how global engineering competency has been conceptualized and the different approaches and outcomes that universities have enacted within undergraduate engineering. Next, we provide an overview of the Rising Sophomore Abroad Program and articulate its objectives as well as outline some of the unique features that have enabled it to scale up enrollments. Finally, we present a suite of evaluation data to demonstrate how different components of the program promote students' global learning and offer suggestions for why we believe the program has been successful.

LITERATURE REVIEW

Developing students' global competency (including problem definition, engineering cultures, local regulation, and engineering ethics) is a central goal of study abroad programs, and research suggests this objective is often achieved, although it may be dependent on program structure or components (Braskamp, Braskamp, and Merrill 2009; Dwyer 2004; Engberg 2013; Vande Berg, Connor-Linton, and Paige 2009). One summary of the outcomes of study abroad research highlights the importance of cultural mentoring, teaching cultural content, reflection on intercultural experiences, engagement across cultures, and consideration of the full study abroad cycle as key components in student development of global competency (Paige and Vande Berg 2012). Within engineering education, Levonisova et al. (2015) reached a similar conclusion in their investigation of how global learning was influenced by different kinds of experiences for 185 undergraduate engineering students from three universities. The authors found positive correlations between students' performance on the Global Perspective Inventory and the Engineering Global Preparedness Index and the duration of study abroad, the number of non-engineering courses with global foci that students completed, the number of times students traveled abroad, and the amount of student reflection that occurred during or after traveling abroad. Other studies have also highlighted growth in global competency

as a result of international research programs that incorporate pro-active learning interventions to develop student global competence (Jesiek, Haller, and Thompson 2014; Ragusa, Matherly, and Phillips 2014).

Researchers have also shown other indirect student outcomes following study abroad opportunities, including enhanced academic success (Ingraham and Peterson 2004), identity development (Miller-Perrin and Thompson 2010), and civic engagement (Tarrant, Rubin, and Stoner 2013). A long-term study that examined 50 years of survey responses from study abroad participants showed that the international experience influenced participants' career decisions, academic attainment, intercultural development, and personal growth (Dwyer 2004). Using the same data, another analysis indicated that participating in study abroad programs influenced over half of the respondents' careers, with nearly half pursuing a globally related career (Norris and Gillespie 2009). Similarly, Paige et al. (2009) showed longer-term civic engagement, philanthropy, and social entrepreneurship all resulted from studying abroad. Thus, the direct benefits (e.g., global competency) and indirect benefits (e.g., academic success, career choice) of engaging in an international experience during college have been demonstrated throughout the literature.

Within engineering education, a variety of global program formats have been introduced in response to the calls for a greater focus on the global preparation of engineers. The most comprehensive programs include global engineering degrees and minors. Examples include the University of Rhode Island's International Engineering Program (IEP), a dual-major program where students complete both an engineering and a foreign language degree over the course of five years (Lohmann, Rollins, and Hoey 2006; Parkinson 2007), and Georgia Tech's International Plan, where students complete international coursework, develop language proficiency, and participate in an immersive experience abroad, ultimately receiving a global designation on their diploma (Bremer 2008; Lohmann, Rollins, and Hoey 2006). More commonly, institutions have introduced engineering-specific study abroad programs, particularly longer-term programs that incorporate either internships or projects. Examples of this include the University of Cincinnati's international co-op program that includes intensive language study and Worchester Polytechnic Institute's Global Perspectives Program, where students participate in a project-based design course abroad (Lohmann, Rollins, and Hoey 2006). Although degree programs and long-term study abroad have significant benefits to learning, they both fail to address the challenges that often prevent engineering students from participating in global programs.

Two forms of global programs that show more promise in engaging larger numbers of engineering students are global courses and short term study abroad. Providing an example of a globally focused course in the curriculum, Downey et al. (2006) outline a course called "Engineering Cultures" designed to fill a humanities requirement for engineers while teaching them about the history of

engineering in different countries and how that influences engineering practice today. Similarly, engineering design courses have introduced international team collaboration projects, where students work on teams with engineering students in other countries (e.g., Maldonado et al. 2014). In a different approach, short-term study abroad is growing in the field of engineering education, most commonly in the form of faculty-led courses where students travel to multiple locations with their faculty leader. Examples of this include the University of San Diego's Compact International Experience program, which offers a fluid dynamics class in France and an electronics course in Australia, both taught in just three weeks (Schubert and Jacobitz 2013), the University of Virginia's courses on cultural design and the history of engineering in Argentina and Panama (Berger and Bailey 2013), and the University of Pittsburgh's Plus3 Program (http://abroad.pitt.edu/plus3engineering), which is a joint business and engineering venture that offers multiple potential international tracks of industry and academic visits. Building on the strengths of both of these program formats, the program described in this paper takes a unique approach by combining a full-length course with a short-term study abroad trip.

Although studies have suggested that longer study abroad experiences have greater impact (e.g., Besterfield-Sacre et al. 2013; Dwyer 2004), well-designed short-term programs can increase students' global competency (Chieffo and Griffiths 2009) and have been pointed to by subject matter experts within the engineering education context as being effective (Besterfield-Sacre et al. 2013). One study demonstrating the importance of implementation is the assessment conducted by Kamdar and Lewis (2015) of a three-week trip consisting mainly of site visits that align with the participants' area of study. Their assessment of long-term goals, short-term goals, and a pre/post-cultural intelligence survey found that simply exposing students to international settings was not enough to meet their program goals. The authors suggested that short-term international experiences need to include pre-trip orientation (e.g., student research of the anticipated locations) and post-trip support (e.g., exercises encouraging student reflection on what was learned during the trip). Such wrap-around reflection is an essential element for effective study abroad programs, as Wayland's (2015) study indicated for the engineering context. Building on this literature, the program described in this paper contains several of those elements, including pre-departure coursework, pre-trip research of sites within the trip itinerary, and reflection following the experience.

Despite the demonstrated benefits of study abroad opportunities, however, they are still wrought with challenges, particularly in an engineering context. As noted, only 5% of engineering students in the United States participate in international enrollments (IIE 2015), and other studies have shown that engineers may enter college less interested in study abroad than those in the humanities (Luo and Jamieson-Drake 2015; Niehaus and Inkelas 2016). Downey et al. (2006) argued that engagement in international projects, work placements, or field trips is unlikely to increase to more than

5–6% of the engineering student body and that expanding integrated class experiences is the most logical, sustainable path forward to garner broad participation. Similarly, Grandin and Hirleman (2009) and Parkinson (2007) outlined the set of challenges that tend to be associated with study abroad programs within engineering. In addition to the scalability issue, recruitment can be seen as an issue as students—and their parents—do not necessarily understand the value of an international experience and are not keen to risk an increased time to graduation. Moreover, some students cannot afford the experience, many do not want to leave behind their community of friends and family for an extended time period, and it can be challenging to navigate scheduling issues with semesters or internships. Beyond students and parents, Parkinson (2007) also pointed to faculty recruitment as a barrier for these kinds of programs, as time spent on planning and administering such programs tends not to be valued in the promotion and tenure system.

The organizational structure of the program described in this paper addresses some of these barriers by design. Importantly, it represents an innovative model that it can be scaled, which both Downey et al. (2006) and Parkinson (2007) pointed to as one of the biggest challenges facing study abroad. Indeed, the 2017 Rising Sophomore Abroad Program enrolled 8% of the entire first year engineering cohort (135 students in total), a 463% growth since 2014.

RISING SOPHOMORE ABROAD PROGRAM OVERVIEW

Background and Objectives

The Rising Sophomore Abroad Program (RSAP) was established by the Virginia Tech College of Engineering in 2008 to provide first-year engineering students with an opportunity to expand their global competencies through an international experience. Housed in the Department of Engineering Education since Summer 2014, RSAP integrates an on-campus, Spring course with a short-term international module immediately following semester exams. The program has undergone rapid growth in size and scope from 24 students traveling to Italy, Switzerland, and Germany in 2014 to 92 students traveling to one of three tracks in 2016: (1) Italy, Switzerland, Germany, (2) Dominican Republic, and (3) China. The 2017 program enrolled 135 students traveling to one of six tracks: (1) Italy, Switzerland, Germany (30 students), (2) Dominican Republic (11 students), (3) China (21 students), (4) New Zealand, Australia (31 students), (5) United Kingdom, Ireland (27 students), and (6) South Africa (15 students). As shown in Appendix 1, the 2016 and 2017 RSAP cohorts were more diverse than the College of Engineering with respect to gender and slightly more diverse than the College with respect to underrepresented minority groups (i.e., combination of Black, Hispanic/Latino, Two or more races).

Short-term	Medium-term	Long-term
Changes in Student Learning	*Changes in Student Action & Behavior*	*Ultimate Benefit*
Through the RSAP experience, students will: 1. Define 'global engineer' and the skills needed to function successfully as an engineer in a range of different cultural settings. 2. Identify global challenges, technological problems, and business opportunities and their implications for American engineers. 3. Describe how differences in political, technological, social, educational and environmental contexts influence engineering practice. 4. Observe and appreciate cultural diversity and how culture impacts engineering in a global society. 5. Engage in a professional environment in an international location.	In college, students will: 1. Engage in meaningful global experiences. 2. Participate in internationally focused campus activities & student organizations. 3. Enroll in courses with an international focus. 4. Serve as thought leaders across campus on contemporary issues within a complex and global environment.	After college, students will: 1. Graduate with engineering degrees and enter workforce or graduate school. 2. Understand how to work in globally distributed teams. 3. Be prepared to solve ill-structured problems at a global level. 4. Be equipped to work in different cultural contexts.

Figure 1. Objectives of the Rising Sophomore Abroad Program.

RSAP provides students with opportunities to expand their global competencies while learning about differences in political, technological, social, cultural, educational and environmental systems. As outlined in Figure 1, in the short-term, the program seeks to help students recognize how differences in contexts matter for engineering problems and solutions, demonstrate how students might navigate cultural or international differences throughout their careers, and provide a structured opportunity for students to learn how to engage in a professional environment in an international location.

Although RSAP might be the only international experience in which some of these engineering students engage, the program hopes to whet many students' appetites for more international-focused study, work, or co-curricular activities. We purposefully define those future international experiences broadly to recognize the logistical difficulties associated with taking part in multiple international experiences, such as curricular and financial limitations. In the medium-term, defined as students' remaining time as undergraduates, we hope students seek out internationally focused activities on campus in the co-curriculum, through internships, or in the courses they choose to take. As outlined in the Program Evaluation section, we are just now beginning to collect data on the medium-term impact of the program.

We define long-term benefits as those that are realized after students graduate. In addition to having graduates enter the workforce or graduate school, we hope that our program alumni will seek out opportunities to engage in international work and feel comfortable working on multinational teams in geographically diverse settings. Such long-term program outcomes align with the calls

for the development of global engineers. We are working hard to maintain a strong relationship with program alumni so that they may be more likely to participate in our data collection requests once they graduate.

Unique Elements of the Program

The structure of RSAP addresses some of the barriers to scaling up study abroad programs within engineering. First, the program consists of a three credit course (described later in greater detail) that incorporates class meetings during the Spring semester as well as the international module. That course qualifies for a general education requirement, so enrolling in the program does not add any credits to students' plans of study. Furthermore, the RSAP class has explicit ties to students' major coursework, as a key objective of the class is to help students recognize how non-technical elements have enormous impacts on their future engineering work.

Second, the program serves as an umbrella for multiple international tracks, like Pittsburgh's Plus3 program, which helps facilitate scalability. All students enroll in the same course but then engage in different international tracks, allowing each individual track to remain a reasonable size. In 2016, for example, 92 students were enrolled in the program, but 42 were in RSAP: Europe, 23 were in RSAP: China, and 27 were in RSAP: Dominican Republic. We added three new tracks in 2017 under this umbrella model to scale up successfully to 135 students, which is 8% of the first-year engineering cohort, surpassing the 5–6% capacity projected by Downey et al. (2006). Having multiple tracks within the same program helps consolidate administrative processes (e.g., one application process instead of multiple processes for each separate track) and provides an opportunity for us to take advantage of the variation in experiences. For example, in addition to talking about differences in contexts at a high level, we can have students explore differences in their experiences across tracks upon their return through reflective work.

Third, we have taken several steps to broaden participation in the program. We partner with the campus office that supports underrepresented students and reach out to student organizations such as the National Society of Black Engineers during our recruitment period. In addition, we incorporate information about the program into Summer Orientation for new engineering students because it is an opportunity to describe the benefits of engaging in the experience to both students and parents. While we always hope for more financial resources, we are able to provide scholarships to students although institutional support that are awarded on a financial need basis. On that note, we have also learned to charge students through the normal "tuition and fees" charges from the university, which automatically are applied when students enroll in courses, instead of a separate program fee. In addition to reducing the administrative workload of collecting payments from students, this model enables students' cost of attendance to include the study abroad costs so that their scholarship and loan opportunities can be enhanced.

Fourth, the timing of the program immediately after exams allows students to spend the entire semester on campus and still secure a summer internship. This timing works within the constraints highlighted in the literature about why students do not study abroad. As noted, we intentionally target students following their first year so that the short-term experience might influence their decisions to engage in international opportunities for the remainder of their time at the university.

Fifth, the model that we follow enables faculty members to engage in the program without adding insurmountable planning and administration time. By having an overarching program with multiple tracks, a single faculty member is responsible for running the Spring class and organizing each international track, with the assistance of graduate students who are interested in supporting study abroad and innovative curricula. Those tasks comprise a major portion of that faculty member's teaching load for the year. Other faculty members in the department then volunteer to lead the international tracks but do not have to develop curricula or plan the logistics of the program. Because the study abroad occurs following exams, those faculty members do not have to balance any additional teaching. These measures have made it easy to recruit faculty members to lead the program, which Parkinson (2007) highlighted as a challenge for such programs. For example, the six tracks of the 2017 program were led by 14 faculty members and three graduate students, but the overarching program was organized by a single faculty member and a team of graduate students.

Spring Semester Class

The class during the Spring semester meets for three hours each week and has undergone a series of developments over the past few years as the program has grown and in response to assessment results. In 2015 and 2016, the full program met for three hours once a week—toward the end of the semester we spent some time splitting into different tracks. However, in response to student feedback, we restructured our approach for Spring 2017 to have the full class meet for two hours once a week and then each international track meet individually for one hour for the duration of the semester. Students felt it would be helpful to spend more time focused on their tracks and with their traveling companions, which seems to have helped the camaraderie on the international tracks. This pre-trip attention has helped the students make the most of their short-term study abroad experiences, which aligns with assertions by Kamdar and Lewis (2015).

In addition to this structural change, the course has evolved into the following three modules, each of which has an associated mini project that students complete: 1) Global Challenges, 2) International Preparation, and 3) Global Communication. We invite a variety of guest speakers from different career stages and disciplinary backgrounds to class to help students think through these topics from a variety of lenses. For example, in 2017 we invited faculty members who specialize in public policy, international development, systems thinking, diversity, leadership, and global communication.

We also invited individuals from industry at both the early career and high-level executive stages to share their experiences working in multinational companies, as well as undergraduates and graduate students who have engaged in international activities during their time at the university to demonstrate the range of potential opportunities for students. Students point to the variety of speakers as a highlight of the program.

Mini projects help students apply what they learn from speakers and class discussions. The primary assessment for the Global Challenges module was a multi-stage group project that tasked students with identifying and defining a "problem" specific to an assigned country and discussing factors that could impact potential solutions. Teams were pre-selected within each international track to further their pre-travel collaboration and assigned a country in the Top 32 in Gross Domestic Product within the same region (i.e., Europe, Asia, the Americas) as the country to which they were travelling. The 6-week project culminated with a poster fair in which student groups presented to the rest of the class; during the poster fair, students were asked to observe similarities and differences across the posters and submitted reflections to encourage learning from one another.

The mini project associated with the International Preparation module tasked students with planning their own study abroad or international internship experience. This project helps students go through the steps that are required to engage internationally as a student and forces them to think through the logistics that were handled by our leadership team for our faculty-led program. In working with the university's Global Education Office, we learned that one of the biggest barriers to students studying abroad is going through the planning process—they found that students assumed such experiences would not fit within their curriculum without trying to make it work. In addition to helping students recognize the steps that are involved in traveling internationally for professional purposes, we hope this project will help students recognize that with the proper advanced planning, longer-term international experiences can fit within their curricula.

The mini project associated with the Global Communication module helped students explore what it might be like to work on a global engineering team. Students were placed in small groups, and each person was assigned a country from a different region of the world (e.g., one team had members assigned Egypt, South Korea, the United Kingdom, Saudi Arabia, Colombia, and Indonesia). The students assumed the role of managers of an international team of engineers from their assigned countries and had to determine how to lead the team effectively. In the first part of the project, each group identified questions they could ask to learn about the cultural and business practices in their assigned countries. Each student then located and communicated with an engineer from their assigned country to discuss those questions. Secondary learning outcomes for this project included learning how to identify professionals and engage in professional correspondence. Students wrote one-page summaries of their conversations and then worked in their groups to

identify similarities and differences between the countries they represented. The final deliverable of the project was a plan outlining three strategies that the group would use as managers to ensure that their global engineering team would work effectively together, using supporting examples from their conversations with engineers. Many students referenced this project in their final reflections on the course, emphasizing that talking with an engineer from another country was a memorable and meaningful experience.

International Module

The international modules that take place in May are designed to help students recognize how contextual factors influence engineering and are comprised of a series of company, university, and cultural site visits. Because students declare their majors at the end of their first year, the visits are designed to showcase a variety of engineering disciplines. Engineering sites are selected to highlight prominent activities or industries in each region—as shown in Appendix 2, for example, we included a pasta factory in Italy, a hydroelectric power plant in Switzerland, and an automobile manufacturing plant in Germany. By following this approach, each track naturally develops different themes from which students can choose. In 2017, for example, the South Africa track emphasized community-based design, the New Zealand/Australia track emphasized earthquake engineering and engineering to support sustainable ecosystems, and the United Kingdom/Ireland track featured behind-the-scenes engineering takes on famous sites such as the Tower Bridge and the London Underground. When appropriate, we also help students make linkages between engineering and the cultural/historical site visits. For example, in preparation for the visit to the Dachau concentration camp, we discussed the role engineers played during the Holocaust and segued into a discussion of ethics in engineering.

Students are required to complete a series of reflective assignments during and following their international module, thereby completing the wrap-around model of study abroad programs as advocated by Wayland (2015). This reflective work has undergone a series of iterations but in 2017 consisted of a daily journal in which students wrote about what they think, do, and learn as well as respond to a series of structured prompts (note: this is the updated version of the reflective assignments; we describe the 2016 version in the Program Evaluation section). Once they are back in the United States, students must create a set of slides to demonstrate what they learned in the program. Those slides are shared with the full program, and students must then look at their colleagues' experiences across tracks and reflect on similarities and differences so that the students can learn from each other. Finally, students must upload a video reflection in which they discuss their experience as if they are in a job interview setting. This assignment helps students reflect on their experiences as a whole and identify the knowledge and skills they developed that could transfer to their future engineering educations and careers. The program's alumni are often able to use this information

in job interviews in the summer or fall after their return and find that being able to talk about their experiences coherently gives them an advantage over other sophomores applying for internships.

PROGRAM EVALUATION

We collect both quantitative and qualitative data before, during, and after the Spring course, international module, and students' graduation from the university. Table 1 provides an overview of timing of the data collection plan for a single cohort. All of the elements listed in the table, including students' assignments during the class (i.e., the mini projects), are covered by an Institutional Review Board protocol pending students' consent, and thus this program can serve as a test case for research on international engineering education. In this paper we describe and provide examples of the following data sources, each of which maps onto at least one short-term outcome in Figure 1: Global Competency Scenario (outcome 1), Sojourn Readiness Assessment (outcome 5), Cultural Intelligence Survey (outcome 4), reflective activities (outcomes 1-5), and evaluation surveys (outcomes 1-5). The mini projects map onto outcomes 2-3 and are described in other publications (Knight et al. 2017). In addition to short-term outcomes (i.e., outcomes following the course and international module), we also have a plan to continue collecting data from program alumni prior to and after their graduation from the university via focus groups, interviews and the engineering career survey (described in Davis and Knight 2017). The sections that follow provide data from students who enrolled in the 2016 program, which enrolled 92 students who participated in one of three international modules: Italy, Switzerland, and Germany; China; or the Dominican Republic.

Table 1. Program evaluation data collection timeline.

	Course			International Module		Graduation	
Data Source	**Before**	**During**	**After**	**During**	**After**	**Before**	**After**
Global Competency Scenario	X		X				
Sojourn Readiness Assessment	X		X				
Cultural Intelligence Survey	X		X		X		
Reflective Activities (e.g., journal)		X		X	X		
Mini Projects		X					
Evaluation Survey			X		X	X	
Interviews & Focus Groups				X		X	
Engineering Career Survey							X

Global Competency Scenario

The Global Competency Scenario (GCS) is a tool that assesses the skills that students think are important in global engineering work, ultimately revealing how they perceive global engineering competency. Developed by Brent Jesiek from Purdue University (unpublished, but country-specific iterations have since been developed) the version of the GCS used in our program is as follows:

Scenario: *Imagine you are an engineer working for a multinational corporation that is expanding operations in both South America and Southeast Asia. You are involved in evaluating the feasibility of the expansion, including finding suitable locations and planning operations. How prepared are you to enter this work situation? What knowledge and capabilities do you have and what do you lack?*

Task: *List and briefly describe five (5) competencies (knowledge, skills, and/or attitudes) you think would be most needed to complete this work assignment.*

We administered the GCS in class at both the start and end of the semester, coded student responses to reduce variation in wording, and compared the frequencies of the codes between the pre- and post-test. The coding process was a constant-comparative method where themes were developed by grouping competencies listed by students into categories and then reviewing each classification for best fit after the final list of categories was developed. The initial set of categories was developed using the pre-test student responses, and a few new categories were added while coding the post-test results. Of the 92 students enrolled in the program, 88 students completed both the pre- and post-class GCS questions, resulting in 440 listed skills for each iteration.

Through the coding process, 59 codes emerged in either the pre- or post-test, with 43 that appeared in both. The most common codes (with 20+ responses on both pre- and post-tests) included "cultural knowledge," "communication," "hard work," "open mind," "adaptability," and "language." Although the most common responses did not change substantially from the pre- to the post-test, a few characteristics experienced more significant jumps or drops in frequency than others. There is not a consistent theme that describes the shifts in the responses, but there are some noteworthy patterns. Characteristics that describe knowledge to be obtained, such as "cultural knowledge," "geography," or "local economy," tended to drop in frequency from the pre- to the post-test. Students also responded less often with general management skills like "communication," "pragmatism," "hard work," or "vision." Instead, students more frequently responded with skills that considered the complex nature of a global project, such as "leadership," "adaptability," "responsibility," and "organization." There was also an increase in responses reflecting the human aspects of projects, such as "empathy," "teamwork," or "listening."

Table 2. Changes in responses to the Global Competency Scenario (GCS) (pre/post-class: n=88)

Biggest Drops - Frequency				Biggest Jumps - Frequency			
	Pre	Post	Change		Pre	Post	Change
Cultural Knowledge	62	51	–11	Empathy	1	16	15
Geography	17	6	–11	Leadership	11	26	15
Communication	58	49	–9	Adaptability	21	35	14
Local Economy	10	2	–8	Responsibility	0	11	11
Pragmatism	8	2	–6	Organization	14	20	6

The competencies that dropped and jumped the most in frequency between the pre- and post-tests are listed in Table 2. Empathy and leadership, in particular, saw the largest shifts, increasing in frequency by 15 between the pre-test and the post-test. We were pleased to see the shifts for those competencies, as the program focuses on helping students recognize the importance of stakeholder needs and contextual differences and how engineers can be successful leaders in such settings. Overall, these results have shown us that students are gaining a more nuanced understanding of global projects and learning; students recognized that human-centered skills and attitudes are important parts of global engineering work.

Sojourn Readiness Assessment

Designed by Jesiek, Haller, and Thompson (2014), the Sojourn Readiness Assessment (SRA) was distributed to students to measure their "general sense of preparedness" for traveling abroad. We distributed the SRA following a pre/post-test design; 90 of 92 students completed both distributions of the SRA, representing a 97.8% response rate, and we conducted paired samples *t*-test analyses. Five of the 20 SRA items significantly increased between the pre- and post-class survey distributions, but two items shifted in unintended directions (Table 3).

Reflecting back on the class topics, we were unsurprised by the items that demonstrated an increase, as we emphasized safety, communication, and easing anxiety. We learned from and used these results to tweak the course for 2017 and emphasized some of the other topics to better prepare students for international travel, completing the course evaluation feedback loop.

Cultural Intelligence Survey

Cultural intelligence has been used to capture multiple skills and competencies, such as global competence, intercultural sensitivity, and cross-cultural communication. Although several models describe this concept (Bennett 1986; King and Baxter Magolda 2005), one thing many of these models have in common is that they describe a framework where individuals undergo multiple

Table 3. Descriptive statistics and t-test results for the Sojourn Readiness Assessment (SRA).

	Pre Class		Post Class		
SRA Items[1]	**Mean**	**s.d.**	**Mean**	**s.d.**	**Diff**
I am anxious about going abroad. (R)	2.90	1.42	3.20	1.55	0.30*
If I need help while abroad, I will know who to contact.	4.28	1.19	5.08	0.82	0.80**
While abroad, I know how to keep in touch with my family.	4.70	1.18	5.07	0.85	0.37*
I am prepared to go abroad.	4.96	0.92	5.08	0.81	0.12
I question if going abroad was a good decision. (R)	1.68	0.83	1.87	1.12	0.19
I can deal with unexpected challenges while abroad.	4.90	0.97	4.90	0.72	0.00
I will be able to communicate effectively while abroad.	4.30	1.01	4.40	1.12	0.10
The benefits of going abroad outweigh the challenges.	5.64	0.53	5.60	0.54	–0.04
I will make the most of my time spent abroad.	5.79	0.46	5.57	0.58	–0.22**
Thinking about going abroad makes me nervous. (R)	2.70	1.20	3.04	1.47	0.34*
I have adequate knowledge about the host country.	3.52	1.11	4.49	0.96	0.97**
Adapting to the host country will be difficult for me. (R)	2.54	0.93	2.58	1.06	0.03
I worry about being away from friends and family. (R)	2.26	1.19	2.37	1.19	0.11
I wish I knew more about the culture of the host country. (R)	4.90	1.04	4.09	1.11	–0.81**
I fear I will have negative experiences while abroad. (R)	2.09	0.92	2.27	1.10	0.18
Going abroad helps support my professional development.	5.43	0.60	5.40	0.58	–0.03
My experiences abroad will help me improve and grow as a person.	5.57	0.58	5.44	0.60	–0.12
While abroad, I will be able to function effectively in most any situation.	4.92	0.80	4.87	0.82	–0.06
I am ready to interact with my foreign peers, colleagues, partners, etc.	5.16	0.81	5.04	0.75	–0.11
I have sound reasons for deciding to go abroad.	5.36	0.64	5.32	0.62	–0.03

[1]1: Strongly disagree, 2: Disagree, 3: Disagree a little bit; 4: Agree a little bit; 5: Agree; 6: Strongly agree
R: designates item was reverse-coded so interpretation of scores is comparable across items
*: $p<.05$, **: $p<.01$

dimensions of development. These dimensions represent different types of development that combine together to describe a larger construct, allowing for the possibility that individuals may develop along dimensions at different rates (Evans et al. 2010). The Cultural Intelligence Survey (CQS), created by Ang et al. (2007), contains 20 survey items measured on a 7-point Likert-scale to measure four dimensions of cultural intelligence: 1) cognitive, 2) metacognitive, 3) motivational, and 4) behavioral. Taken together, these dimensions comprise the notion of cultural intelligence that describe the knowledge, skills, and attitudes needed to interact across cultures (Ang et al. 2007). As noted in Table 4, the CQS was administered three times in the program: the first day of class, the last day of class, and online after students returned from their international modules. Student response rates limited inferences that could be made for the post-international modules. 90 students of 92 (97.8%) completed both the pre- and post-class distributions of the CQS;

however, only 42 (45.7%) completed the post-trip assessment. For the purposes of this paper, we report only the comparisons between the pre- and post-class responses.

Differences in students' responses between the pre- and post-class surveys were analyzed using a paired samples t-test (see Table 4). We observed statistically significant increases between the beginning and end of the semester administrations for three of the four constructs (cognitive, metacognitive, and behavioral) and 13 of 20 items. The fourth construct, motivational, did not show statistically significant changes in the pre- to post-test comparisons. Despite the noted response

Table 4. Descriptive statistics and t-test results for the Cultural Intelligence Survey (CQS).

	Pre-Class		Post-Class		
CQS Constructs and Items[1]	**Mean**	**s.d.**	**Mean**	**s.d.**	**Diff**
Cognitive	3.46	0.98	4.20	0.97	0.74**
I know the rules (e.g., grammar) of other languages.	3.16	1.45	3.63	1.54	0.48**
I know the religious beliefs of other cultures.	3.97	1.18	4.21	1.32	0.24
I know the marriage systems of other cultures.	3.18	1.24	3.41	1.33	0.23
I know the rules for expressing non-verbal behaviors in other cultures.	2.96	1.32	4.18	1.26	1.22**
I know the legal and economic systems of other cultures.	3.19	1.24	4.14	1.41	0.96**
I know the arts and crafts of other cultures.	3.70	1.47	4.19	1.30	0.49**
Metacognition	4.93	1.08	5.36	0.88	0.42**
I am conscious of the cultural knowledge I apply to cross-cultural interactions.	4.51	1.36	5.30	1.22	0.79**
I check the accuracy of my cultural knowledge as I interact with people from different cultures.	4.88	1.41	5.36	1.19	0.48*
I am conscious of the cultural knowledge I use when interacting with people with different cultural backgrounds.	4.80	1.21	5.42	1.24	0.62**
I adjust my cultural knowledge as I interact with people from a culture that is unfamiliar to me.	5.30	1.10	5.66	1.05	0.36*
Behavioral	4.78	1.30	5.30	1.01	0.52*
I alter my facial expressions when a cross-cultural interaction requires it.	4.39	1.44	4.97	1.16	0.58**
I change my verbal behavior when a cross-cultural interaction requires it.	4.78	1.36	5.17	1.07	0.39*
I change my non-verbal behavior when a cross-cultural situation requires it.	4.57	1.41	5.31	1.11	0.74**
I use pause and silence differently to suit different cross-cultural situations.	4.33	1.43	5.01	1.24	0.68**
I vary the rate of my speaking when a cross-cultural situation requires it.	4.82	1.44	5.28	1.22	0.46*
Motivational	5.67	0.76	5.70	1.01	0.03
I enjoy living in cultures that are unfamiliar to me.	5.29	1.40	5.43	1.26	0.14
I am confident that I can socialize with locals in a culture that is unfamiliar to me.	4.98	1.37	5.11	1.26	0.13
I am confident that I can get accustomed to the life style in a different culture.	5.68	1.13	5.70	1.04	0.02
I enjoy interacting with people from different cultures.	6.07	1.11	6.00	1.06	–0.07
I am sure I can deal with the stresses of adjusting to a culture that is new to me.	5.97	0.93	5.93	1.00	–0.03

[1] 1: Strongly disagree; 7 (Strongly agree) (no labels assigned to 2–6)
*: $p<.05$, **: $p<.01$

rate differences for the post-international module administration of the assessment, we did observe significant increases for four of the five motivational construct items following the international module (not shown). Thus, we have preliminary evidence that the constructs embedded within this assessment appear to behave differently following different kinds of experiences associated with our program.

Post-International Module Reflections

Following the international module, students from all tracks wrote a final reflection essay in which they addressed the following questions in the context of an interview for an internship: (1) What new knowledge or skills did you learn or build upon while you were abroad? (2) What specific examples from the in-semester class or international module helped you develop those skills? (3) How can the RSAP international experience be a value-add for my company/organization? 83 students submitted essays, which were analyzed for themes and common experiences. (Note: The assignment described here is the 2016 version of the final project, which is different than what was presented earlier for the 2017 version. We continually adjust the assignments based on assessment results and student feedback.)

In reviewing student essays, it became evident that students could engage in similar experiences yet take away completely different lessons (see Appendix 3 for the wide variation in frequencies across themes). For example, the topic that was described in a majority of essays was how students negotiated situations in which they needed to communicate with someone who did not speak English. In general, students seemed to find such instances to be one of the most significant parts of their time abroad, but there were differences in how they interpreted these situations. Many students focused on how their communication skills improved, as they learned to use body language or key phrases in another language. One of the students who took this approach wrote:

> *"You have to be good at interacting with people in order to get anything you want in a country where nobody speaks your language and you don't speak the native language. Body language is beyond important, and being able to control the tone of one's voice during interactions is surprisingly important."*

Other students stated that they grew in their willingness to face new or unfamiliar situations, often relating these ideas to the work environment. For example, one student said:

> *"Being in these kinds of situations made me realize that no matter how dreadful a situation may seem, one can always make it out in the end. I used to try to avoid uncomfortable situations, but now I am much more open to them."*

Some students described how their self-confidence levels grew as they discovered that they could manage such interactions more smoothly than they had anticipated. One student put it this way:

"Because I had to be so responsible, I now feel a lot more independent. I feel a lot more confident in my capabilities to handle situations. I have a tendency to question myself, but now I realize how much more I can do on my own."

Finally, a few students reflected on how this experience has caused them to empathize with international individuals living in the United States and discussed how they might help foreign students or colleagues feel more comfortable. An example of this response is:

"One piece of wisdom the whole experience imparted upon me was the value of compassion for people in foreign situations. Not only did we discuss real life problems pertaining to this in the class (such as the refugee crisis), but I was able to first-handedly experience feeling helpless in a foreign culture."

Simply providing an experience is not sufficient to lead to reflective student learning, as some students were able to gain significant insight through the same experience of cross-cultural communication, whereas others saw limited learning opportunities. These differences are important for us as instructors to recognize as we prepare learning activities and have caused us to build in more instruction about how to reflect on such experiences.

One area where we expected to see differences in themes was across tracks, and this did occur to some extent. Although some themes, such as communication and descriptions of cultural differences, were consistent across tracks, there were also themes that showed up more strongly within individual tracks (Appendix 3). For example, the Europe track's most popular topic was "adaptability," where students discussed some logistical challenges faced on the trip and how they learned about the uncertainty associated with international travel. The students on the China track had the opportunity to talk to Chinese university students, and many of those students wrote about being surprised at how much they have in common with people on the other side of the world. The DR track gave students the chance to work with each other and locals on a project, which showed up in their essays through emphasis on teamwork and what they learned from the Dominican culture. Both the Europe and DR tracks had several students discuss differences in engineering practices between countries, yet far fewer students on the China track wrote about this. These differences appear to be related to the variation in content of the trips, which will be brought into the planning processes for future cohorts so that we can be more intentional about ensuring different learning outcomes are met.

Evaluation Survey

Following the international module, 43 students responded to two questions in the post-program survey that asked "How has participation in the RSAP program affected your future [academic] or [career] plans or interests?" The responses were open-ended, allowing students to identify for themselves what might qualify as academic or career interests. As a result, a variety of topics were discussed in these responses, which we coded to identify common themes. The response rate dropped for this survey relative to other assessments because it was administered during summer vacation once students returned from their international experience. In subsequent years, we incorporated the survey into the set of materials that needed to be completed as part of the course's formal assessment, and we received a much higher response rate.

Most students indicated that engaging in the program impacted both their academic (88%) and career (86%) plans and interests (see Table 5). In both academic and career responses, students tended to discuss concrete actions they could take in school and in their careers. The top academic responses were that students would like to study abroad, engage in more global co-curricular activities, and travel internationally for fun. Similarly, top career responses were that students would like to work abroad or find a job that would allow them to travel internationally for work. A significant

Table 5. Themes of student responses related to academic and career impacts of the program (n=43).

Category	Descriptor	Percentage
Academic	RSAP impacted my academic plans and interests	88%
	RSAP has increased or inspired my desire to study abroad	56%
	RSAP has encouraged me to join a global focused extracurricular activity	23%
	RSAP has increased my interest in learning about international engineering practices	16%
	RSAP has increased my interest in learning a foreign language	14%
	RSAP has made me interested in finding an internship/co-op abroad	14%
	RSAP has increased my interest in learning about other cultures	12%
	RSAP helped me focus on an area of my major that I am interested in pursuing	7%
	RSAP helped me develop a more global perspective on life and engineering	7%
	I'm not sure if RSAP has impacted my academic plans and interests	7%
Career	RSAP impacted my career plans and interests	86%
	RSAP has made me open to the idea of working abroad	44%
	RSAP has made me want to get a job where I can travel abroad	19%
	RSAP has had no impact on my career plans and interests	14%
	RSAP has made me interested in pursuing a job at a specific company that we visited	7%
Personal	RSAP has increased my interest in traveling abroad for fun	16%
	RSAP helped me make friends and build a network on campus	7%

number of students also discussed topics that they would like to continue to learn about throughout their college and professional careers, including international engineering practices, foreign languages, and cultural practices. One type of response that is conspicuously absent for this cohort is that no students mentioned RSAP as an influence on their major selection or interest in a specific career path. A minority of students mentioned a new interest in a sub-field of their major, and one discussed choosing a new minor. Our future work will ask explicitly about major selection or career trajectories. Overall, however, this program appears to impact how students think about both their academic and career plans.

DISCUSSION

Across the evaluation measures, we demonstrate shifts in students' knowledge, attitudes, and skills across several of our program's intended learning outcomes following both the integrated class and the international field trip. For the first learning outcome (i.e., define "global engineer" and the skills needed to function successfully as an engineer in a range of cultural settings), the Global Competency Scenario administered before and after the class demonstrated that students gained a more nuanced understanding of global projects and learning. They recognized that human-centered skills and attitudes are important parts of global engineering work. Although students entered the class with a general sense of the professional skills required for engineers to be successful, shifts in this measure demonstrate that a focused course can help extend students' understanding.

In addition to specific projects in class, we used the post-international module reflections and evaluation surveys to gain insights on students' development around the second and third learning outcomes. Reflections showed that students on both the Europe and DR tracks discussed differences in engineering practices, but we had fewer students point to those differences on the China track. We have a few potential explanations for that finding, a students in China had a much greater cultural and language barrier to overcome, and so those challenges seemed to dominate their open-ended reflections. Additionally, we have since provided more structure to the reflections to ask students to reflect on connections between engineering and culture explicitly, and so we are now sure to gather data on these outcomes specifically. More broadly, we also have changed our class to incorporate focused instruction on reflection because some students tended to report on activities instead of approaching the task more deeply and meaningfully. We hope this shift will lead to a greater demonstration of learning via this data collection mechanism.

A second potential explanation for the different China result could be that 2016 was the first year we had students on that track. Finding the right kind of company contacts to promote enriching

educational experiences for first year engineers takes time, and so each year we evaluate the quality of different visits and adjust accordingly. We do note, however, that standardization across tracks in the kinds of learning experiences that can happen should not necessarily be the goal because different contexts afford different opportunities. In addition to being transparent with students about differences in the itinerary, we could also help make the connection between the itinerary and the expected specific learning experiences and outcomes across the tracks for students as they select a track. Although we strive to make the overarching program outcomes consistent across the tracks, the specific ways in which they manifest themselves differ.

Several measures point to development along the fourth outcome (i.e., observe and appreciate cultural diversity and how culture impacts engineering in a global society). The Cultural Intelligence Survey demonstrated that cognitive, metacognitive, and behavioral dimensions saw an uptick after the class. We also saw evidence that the motivational dimension increased following the international module. This finding shows the benefit of combining two different educational experiences (an integrated class and international field trip) into the same program as features of each program enable different forms of student development. Students' reflections also pointed to the program meeting this outcome, although we noted that different students had entirely different take-aways from the same experience. One shift to the program after 2016 incorporated a structured assignment where students had to look across their peers' reflections so that students' own perspectives might be broadened even further.

Finally, we saw development toward the fifth outcome (i.e., engage in a professional environment in an international environment) in both a short and specific sense as well as a projected longer timeline. The Sojourn Readiness Assessment demonstrated that students felt more comfortable with safety and communication issues related to international travel following the class, which we emphasized repeatedly. In a broader sense, however, students pointed to having a desire to find other international engagement opportunities during their time as an undergraduate in the evaluation survey, which further suggests we helped ease their comfort levels in the program. It appears that they saw the personal and professional benefit of these kinds of experiences, and that outcome further justifies placing this program in students' first year of study so that they have opportunities to seek other international experiences. As Shuman et al. (2016) argue, building on prior international experiences and encouraging students to engage in multiple international experiences might be important for helping students develop global preparedness. Positioning a program like RSAP in the first year of study with such an explicit focus on why global engineering matters and how students can engage internationally enables students to seek out future international opportunities that can be more focused on their disciplinary specializations.

Across these measures, we demonstrate how both the class and international module spurred development in different ways. Our findings join the existing body of literature that well-designed

short-term programs can effectively increase students' global competency (Besterfield-Sacre et al. 2013; Dwyer 2004). Although Levonisova et al. (2015) pointed out that the duration of study abroad experiences correlated with certain measures of global learning, we demonstrate that even short-term programs can spur development across a range of measures. However, we agree with Kamdar and Lewis (2015) that we would not have seen such development in this short-term program if we had not had students engage in targeted and repeated reflection. As Levonisova et al. (2015) also found, incorporating reflection during and after international experiences also correlated with students' global learning, and perhaps the structured reflection in our program—which we are seeking to enhance moving forward—helps ensure learning despite the short international program duration. Additionally, what sets our program apart from other examples of short-term programs is the inclusion of the semester-long class prior to the international travel. Our evaluation measures demonstrate that both experiences spurred learning in different ways, and the blended approach of combining an integrated class experience with the international field trip appeared to enhance students' learning beyond what could have happened in either experience independently. We acknowledge that students self-selected into this program, and thus may have been primed for these kinds of gains relative to students who are not motivated to engage in such experiences. However, we were unable to account for this selection threat to validity because we were not able to enroll students who would have not been interested in the program.

CONCLUSIONS AND FUTURE WORK

To prepare students to enter a more globally connected work environment, engineering programs should seek to educate "global engineers" and integrate global competence across curricula, which can be done in a variety of different ways. The Rising Sophomore Abroad Program presented in this paper describes an integrated class experience combined with an international field trip. Built upon best practices of international student experiences highlighted in the literature, the program includes pre-departure coursework, pre-trip research of sites within the trip itinerary, and reflection following the experience.

The Rising Sophomore Abroad Program contains unique elements and structures that intentionally address some of the known challenges associated with study abroad in undergraduate engineering. First, the experience is tied to a course that meets students' general education requirements, thereby avoiding additional credit requirements for students while simultaneously and intentionally integrating general education into students' engineering coursework. Second, the program's umbrella structure with multiple international tracks has facilitated scaling up to 8% of the first year engineering cohort

while enabling cross-track comparisons so that students can learn from peers' experiences as well as their own. Third, the program has successfully enrolled underrepresented students through targeted recruitment. Fourth, we have embedded costs within the university's tuition and fee structure so that participation can count toward students' cost of attendance. Fifth, the timing of the program allows students to engage in an international experience while not missing a semester on campus or opportunities to engage in summer internships. Finally, the program structure enables many faculty to participate in the program while not requiring large amounts of planning and administration time, which has resulted in tremendous faculty engagement. Other programs seeking to scale up international engagement for engineering undergraduates could follow the RSAP model by starting with a single international track tied to a semester-long course and then expanding over time. Rather than conceptualizing a program with large enrollments from the beginning, RSAP demonstrates a way to phase in scaling over time without requiring many new resources.

Much of our evaluation of the program to date has focused on short-term program outcomes. Quantitative and qualitative evaluation measures have demonstrated that the program is successfully helping students develop global competency, but we are constantly evolving the program to enhance development of each outcome. Moreover, students develop different outcomes from the integrated class module and the international field trip, and we believe the blended approach of both experiences enhances what can be gained from either option independently. We recommend that programs seeking to expand numbers of students going abroad should recognize that short-term programs may likely be the way to do so within undergraduate engineering constraints. From a curriculum development perspective, attaching a semester-long integrated class to that experience may overcome shortcomings of short-term study abroad programs.

Moving forward, our team will continue administering the short-term assessments described in this paper and pay close attention to any differences in learning outcomes across international tracks. By expanding the number of tracks to different regions that vary in different ways from the U.S. context (e.g., language, engineering practice, attitudes toward sustainability), we are designing focused research to explore how and why different contextual factors of international tracks lead to different student outcomes. We have also developed medium-term (i.e., over the course of the college experience) and long-term (i.e., into students' careers) objectives for the program; we are currently collecting data on the medium-term timescale and are looking forward to learning from those findings to continue enhancing the program.

Programmatically, we will complete a full evaluation of the class and international tracks annually and continue making data-informed adjustments to the experience. Student and faculty participants always provide excellent ideas to continue enhancing the program, and there is always a learning curve following the first year offering a new international track. In addition to tweaking the six existing

tracks, we will investigate adding new tracks as we project continued growth in student demand for the program. By connecting the experience to the general education curriculum and following the umbrella structure with multiple international tracks, we believe our program can continue expanding in a sustainable manner while maintaining high quality student learning experiences as we seek to develop the next generation of global engineers.

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APPENDIX

Appendix 1. Demographic comparison of the RSAP 2016 and 2017 cohorts and the College of Engineering in aggregate.[1]

	RSAP		College of Engineering	
	2016 (n=92)	2017 (n=135)	2016	2017
Men	46%	57%	79%	78%
Women	54%	43%	21%	22%
Two or more	5%	5%	5%	5%
Asian	5%	14%	13%	14%
Black	4%	7%	3%	3%
Hispanic/Latino	8%	3%	6%	6%
White	78%	72%	73%	72%

[1]"Not reported" is not included in the calculations because of differences between RSAP data and College data. We only include race/ethnicities that appeared in the RSAP data for comparative purposes (i.e., there were no American Indian participants, but the College of Engineering has an extremely small percentage of students from this background).

Appendix 2. Sample of site visits, lectures, and tours (RSAP: Europe 2015).

Country	Visits/Lectures/Tours	Visit Type
Italy	Lamborghini Museum and Factory	Engineering Focused
	Barilla Academy and Factory	Engineering Focused
	Italian Fashion School in Milan	Academic
	Last Supper painting	Cultural
Switzerland	Grimsel Power Plant Tour	Engineering Focused
	Entlebuch Biosphere Tour	Engineering Focused
	University of Lucerne	Academic
Germany	Deutsches Museum	Engineering Focused
	Innovation Academy	Engineering Focused
	Bodensee Solar Boat Lake Cruise	Engineering Focused
	Hilti Drilling Company	Engineering Focused
	BMW World	Engineering Focused
	KUKA Robotics	Engineering Focused
	Brewery Factory Tour	Engineering Focused
	Neuschwanstein Castle	Cultural
	Dachau Concentration Camp	Cultural
France	Institut National des Sciences Appliquées (INSA)	Academic
	Strasbourg Cathedral	Cultural

Appendix 3. Themes from student reflections across tracks.

Code	China (n=23)	DR (n=27)	Europe (n=33)	Overall (n=83)	Key
Communication	87%	44%	52%	59%	
Cultural differences	52%	52%	36%	46%	>= 50%
Adaptability	26%	26%	58%	39%	25–49% students
Different engineering practices	17%	37%	52%	37%	10–24% students
Facing new/unfamiliar situations	43%	19%	27%	29%	5–10% students
Respect for other cultures	22%	26%	24%	24%	< %5 students
Pre-trip preparation	39%	19%	12%	22%	
Global perspective	26%	22%	15%	20%	
Learning from the culture	9%	37%	15%	20%	
Self-confidence	13%	19%	24%	19%	
Design based on listening	22%	30%	6%	18%	
Teamwork	4%	30%	12%	16%	
What we have in common	30%	7%	6%	13%	
Global problem solving skills	9%	15%	12%	12%	
Curiosity/adventure	17%	15%	3%	11%	
Better together	9%	7%	9%	8%	
Empathy for internationals in US	9%	4%	9%	7%	
Impact of solutions	4%	11%	6%	7%	
Recognizing attitudes of American superiority	9%	7%	3%	6%	
Contextual influences on engineering	0%	7%	9%	6%	
Time management	4%	0%	9%	5%	
Career goals	0%	4%	6%	4%	
Ethical responsibility	0%	4%	6%	4%	
# Student Essays	**23**	**27**	**33**	**83**	